1. INTRODUCTION:

Menstruation and menstrual practices still face many Social, cultural, and religious restrictions which are a big barrier in the path of menstrual hygiene Management. In many parts of the country especially in Rural areas girls are not prepared and aware about Menstruation so they face many difficulties and Challenges at home, schools, and work places. Sanitary waste disposal has also become an issue in India, since the plastic used in sanitary napkins are not bio-degradable and result in environmental and health dangers. The proposed system is to present the invention, thereby contemplates an essentially simple portable construction, adapted to be hung on any wall in a lavatory in order to dispose of sanitary napkins conveniently, efficiently, and economically. The Present research work deals with an effective solution to dump and dispose the menstrual waste with the help of an incinerator. The Sanitary Napkin Incinerator disposes napkins in an environment friendly method by burning the pads and converting it into ash.

Although the disclosed device has the same principle of operation, here the heat Produced is used to burn the sanitary napkin which is Dumped into the incinerator. For this purpose, the most used heating coil made up of Ni-Chrome Alloy is used. When the Sanitary napkin burns, it is reduced to ashes. The burnt Ashes will be collected at the removable ash collector. Heaps of sanitary napkins with many disease-causing bacteria on them pose a significant Threat to the hygiene in the surrounding area. In this Current research work is focused on the design and Analysis of an automated incinerator. It helps to dispose sanitary napkin in hygienic way without generating harmful emission.

1.1. Menstrual waste disposal practices among girls in India:

- Throw with Routine Waste/dustbin – Concerns: Unsegregated menstrual waste enters the solid waste stream and is subject to the same treatment as other solid waste – placed in landfills to disintegrate over hundreds of years.
- Thrown Away in the open (open Spaces, Rivers, Lakes, Wells, Roadside) Concerns: Menstrual waste can contaminate water sources, clog drain sewerage systems .
- Burning (open)_–Concerns :Burning of commercially available pads at low temperatures can release toxins such as dioxins and furans into the surrounding atmosphere.

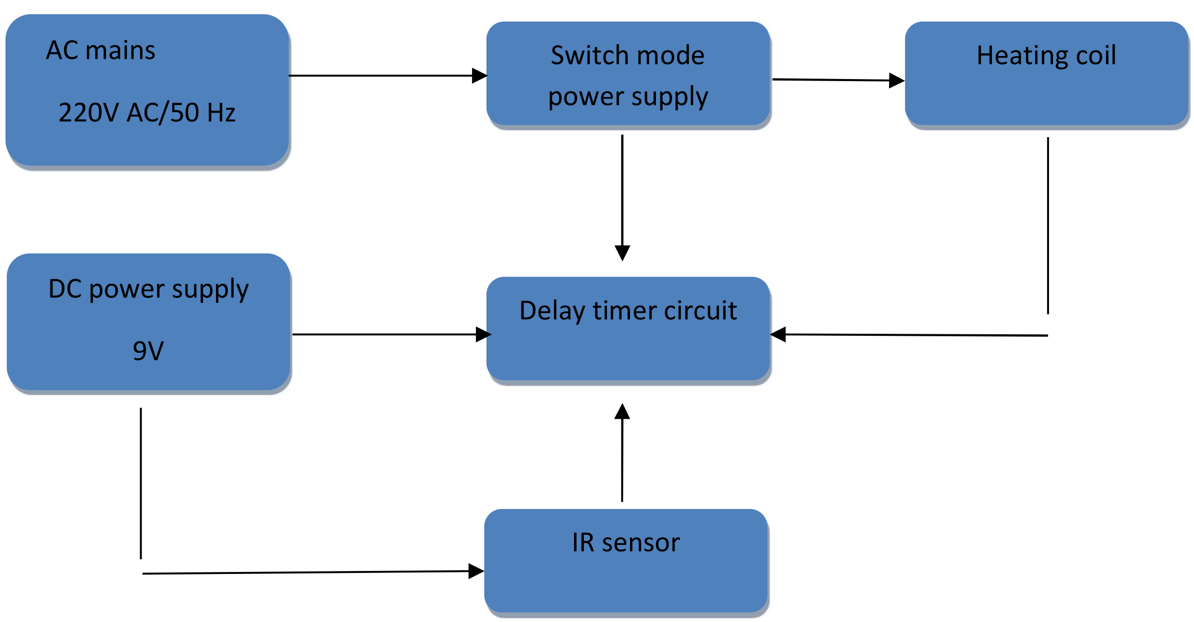
- ❖ Burying -Concerns: Shallow burial is often practiced, and products can be easily exposed or dug up by animals. Not all products disintegrate when buried.
- ❖ In toilets (flushing Down the Toilet,Throwing In pit Latrine)-Concerns: Used pads mixed with faecal sludge, complicates removal and disposal of that sludge (in the case of septic tanks) or interferes with the production of usable manure (in the case of leach pits). They can also clog up sewerage systems.

2. OBJECTIVE:

- ❖ Heating a nichrome wire to burn a paper.
- ❖ Making the product cost effective.
- ❖ Designing auto turn on and turnoff circuits.
- ❖ To design a prototype of Hygienic sanitary napkin disposal system, which could be used to reduce the problem of Disposing of sanitary waste.

3. BLOCK DIAGRAM:

3.1. Block diagram of the project:



3.2. Prototype:

In the prototype, we made a portable body which can be mount on walls and contain all the electronic components required to burn the sanitary napkin. Inside the body, there are different sections for the battery, SMPS, Delay circuit, IR sensor, Grid, Ash tray etc. In table 1 we have shown the components and their dimensions.

Fig.1 Front view

Fig.2 Angular view

Fig.3 Side view

Fig.4 Battery and SMPS

Fig.5 IR sensor and Delay circuit

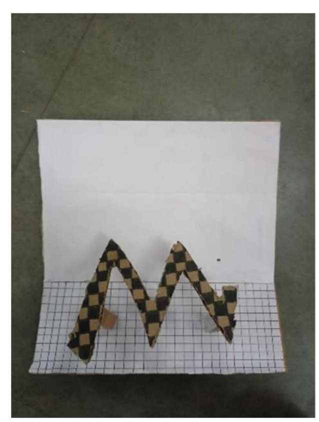


Fig.6 Coil and Grid

Table.1 Parts of the prototype and their dimensions in cm.

S.no	Components	Dimensions(cm)
1.	Body	23*23*32(l*b*h)
2.	Battery	12*17*18 (l*b*h)
3.	SMPS	20*10*4.5 (l*b*h)
4.	Delay Circuit	5*7 (l*b)
5.	IR Sensor	5*7 (l*b)
6.	Ash Tray	23*6.4 (l*b)
7.	Slope	23*20 (l*b)
8.	Grid	23*6.4 (l*b)
9.	Coil	30(l)

3.3. Workflow of the project:

1. Loading: The used sanitary pads are loaded into the incinerator through a loading door. After loading it auto closes due to a spring mechanism.
2. Sensing: When palm is shown, triggering signal is produced turning on delay timer circuit.
3. Ignition: The incinerator is then ignited using an electric heating element (coil), which generates a high-temperature.
4. Combustion: The used sanitary pads are then burned in the high-temperature coil, The combustion process is highly efficient, with most of the organic materials being converted to carbon dioxide, water vapor, and ash.
5. Auto turnoff: When the timer is completed the power auto cuts with the help of Relay in Delay timer circuit.
6. Exhaust: The resulting gases and ash are then exhausted through a chimney, which helps to filter out any remaining pollutants or particulate matter.

4. CIRCUIT DIAGRAM:

4.1. DELAY TIMER:

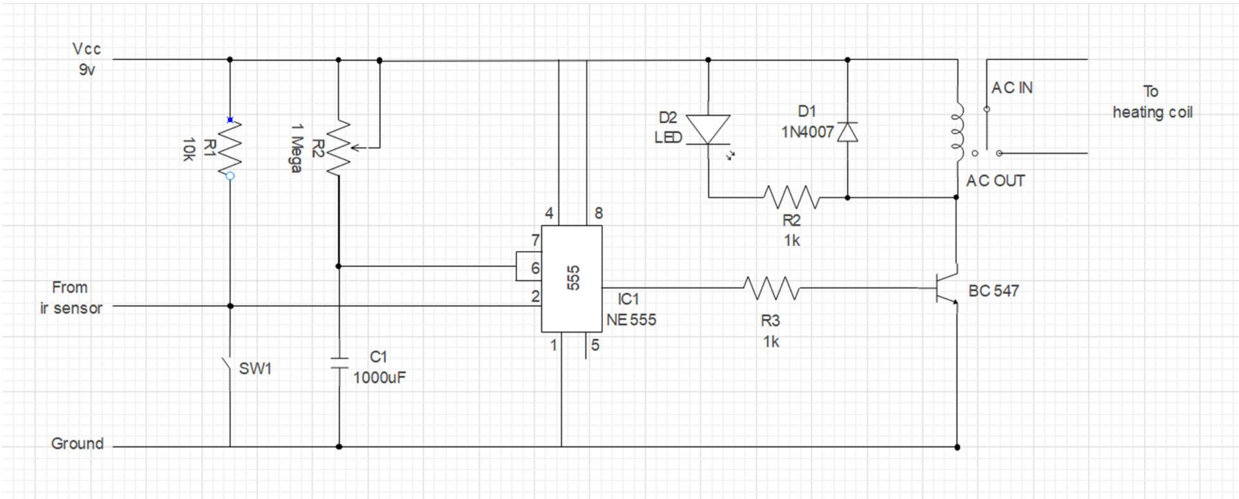


Fig. 7 Delay timer circuit.

- ❖ A delay timer circuit is an electronic circuit that produces a delay before providing an output signal. It is commonly used in applications where a delay is required, such as in controlling the opening and closing of doors, switches, and valves.
- ❖ The delay time produced by the delay timer circuit can be adjusted by changing the value of the timing resistor or the timing capacitor.
- ❖ Additionally, the reference voltage can also be adjusted to fine-tune the delay time. Overall, delay timer circuits are simple and useful electronic circuits that can be used in a variety of applications where a delay is required.

4.1.1. Working Principle of delay timer circuit:

When the circuit is powered on, the timing capacitor starts to charge through the timing resistor. As the capacitor charges, the voltage across it increases. The comparator continuously compares the voltage across the timing capacitor with a reference voltage. When the voltage across the timing capacitor reaches the reference voltage, the comparator produces an output signal that triggers the output stage. The output stage provides an output signal that can be used to trigger an event, such as turning on a light or opening a door.

4.2. IR SENSOR MODULE:

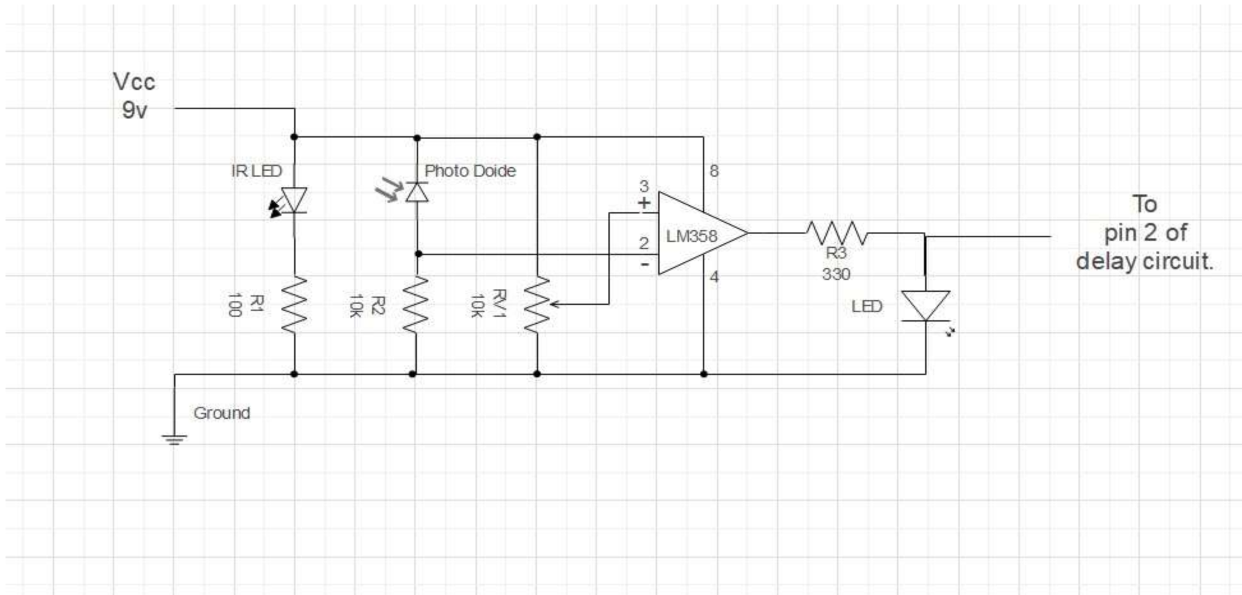


Fig. 8 IR Sensor Module.

- An IR (infrared) sensor module is an electronic device that detects infrared radiation emitted by objects in its field of view.
- When an IR sensor module is placed in the proximity of an object, the IR emitter emits infrared radiation that reflects off the object and returns to the IR detector. The IR detector generates a current signal that is proportional to the intensity of the received radiation. This signal is then processed by the signal conditioning circuit and the output stage, and the resulting output signal is used to trigger an event or provide information about the object being detected.
- Overall, IR sensor modules are versatile and useful electronic devices that can be used in a wide variety of applications, including security systems, automation, robotics, and temperature sensing.

4.2.1. The basic working principle of an IR sensor module is as follows:

The IR transmitter emits infrared radiation, which travels through the air until it reaches an object in the module's field of view. The radiation reflects off the object and is detected by the IR receiver. The IR receiver generates a signal that is proportional to the intensity of the received radiation. The signal is then amplified and filtered to remove any noise or interference. The processed signal is then compared to a predetermined threshold level, and if it exceeds this threshold, a trigger signal is generated. The trigger signal can be used to activate a device or perform a desired action, such as turning on a light or sounding an alarm.

4.3. SMPS:

- ❖ SMPS stands for Switched-Mode Power Supply. It is an electronic power supply that uses a switching regulator to convert electrical power efficiently. It is power supply unit (PSU) generally used in computers to convert the voltage into the computer acceptable range.
- ❖ The disadvantages of LPS such as lower efficiency, the need for large value of capacitors to reduce ripples and heavy and costly transformers etc. are overcome by the implementation of Switched Mode Power Supplies.
- ❖ The working of SMPS is simply understood by knowing that the transistor used in LPS is used to control the voltage drop while the transistor in SMPS is used as a controlled switch.

4.3.1. Working principle of an SMPS is as follows:

AC voltage from the mains power supply is first rectified into a pulsating DC voltage. The pulsating DC voltage is then fed into a high-frequency oscillator circuit. The oscillator circuit switches the DC voltage on and off at a high frequency (typically tens or hundreds of kHz). The switched DC voltage is then fed into a transformer, which steps the voltage up or down depending on the required output voltage. The output from the transformer is then rectified and filtered to produce a clean and regulated DC output voltage. The high-frequency switching allows for more efficient power conversion compared to linear power supplies because less energy is lost as heat. This makes SMPSs more compact, lighter, and more efficient than traditional linear power supplies. They are commonly used in electronic devices such as computers, televisions, and audio amplifiers, as well as in industrial applications such as motor drives and lighting systems.

5. COMPONENTS:

5.1. Switched-mode power supply:

Table.2 Components used in SMPS and their quantities.

S.no	Components	Quantity
1.	Fuse	1-2A, 1-250V
2.	Supply	85V - 265V
3.	MOV (Metal oxide varistor)	1-SVC 561
4.	Dual Line Filter – Inductor	
5.	Resistor	1-1MΩ, 1-480Ω, 1-56Ω, 1-39Ω, 1-150Ω, 1-10kΩ, 1-220 Ω
6.	Capacitor	1-0.1nF, 1-47μF 50V, 2-10nF, 1-1nF, 1-22 μF 400 V ,1-1000 μF 10V, 1- 470 μF 10V
7.	Diode IR 107	1
8.	PFC – Transformer	1
9.	Diode	1- Rectifier YG802C04
10.	FR104 Rectifier	1
11.	Series Load Control (prevent overload)	1
12.	IC-5M0265R	1
13.	Two Inductor	1
14.	TL 4C1 (Zener Reference)	1
15.	Octo Coupler, photo Diode	1- PC 817

5.1.1. Input Stage:

The AC input supply signal 50 Hz is given directly to the rectifier and filter circuit combination without using any transformer. This output will have many variations and the capacitance value of the capacitor should be higher to handle the input fluctuations. This unregulated dc is given to the central switching section of SMPS.

5.1.2. Switching Section:

A fast-switching device such as a Power transistor or a MOSFET is employed in this section, which switches ON and OFF according to the variations and this output is given to the primary of the transformer present in this section. The transformer used here are much smaller and lighter ones unlike the ones used for 60 Hz supply. These are much efficient and hence the power conversion ratio is higher.

5.1.3. Output Stage:

The output signal from the switching section is again rectified and filtered, to get the required DC voltage. This is a regulated output voltage which is then given to the control circuit, which is a feedback circuit. The final output is obtained after considering the feedback signal.

5.1.4. Control Unit:

This unit is the feedback circuit which has many sections. The output sensor senses the signal and joins it to the control unit. The signal is isolated from the other section so that any sudden spikes should not affect the circuitry. A reference voltage is given as one input along with the signal to the error amplifier which is a comparator that compares the signal with the required signal level. By controlling the chopping frequency, the final voltage level is maintained. This is controlled by comparing the inputs given to the error amplifier, whose output helps to decide whether to increase or decrease the chopping frequency. The PWM oscillator produces a standard PWM wave fixed frequency.

5.2. Delay Timer Circuit:

Table.3 Components used in Delay Timer Circuit.

S.no	**Components**	**Quantity**
1.	Supply	1-9V(VCC)
2.	Resistance	1-10KΩ, 1-1MΩ, 2-1KΩ
3.	Capacitance	1-1000μF
4.	Diode	D1- 1N4007
5.	555IC	1-NE555
6.	Transistor	1-BC547/548
7.	Relay	5V to 10V

5.2.1. Timing resistor

The timing resistor is a component that determines the time delay of the circuit. It is usually a variable resistor or potentiometer that can be adjusted to set the delay time.

5.2.2. Timing capacitor

The timing capacitor is a component that stores charge and discharges over time. The time it takes for the capacitor to discharge is determined by the value of the timing resistor, and this time delay is what the delay timer circuit produces.

5.2.3. 555 timer IC

The 555 timer IC is a popular and versatile integrated circuit that can be used to build a variety of electronic circuits, including delay circuits. Here is how a basic delay circuit using the 555 timer works:

Connect pin 8 of the 555 timer IC to the positive supply voltage (+V_{cc}), and pin 1 to ground (GND). The delay time is determined by the values of two resistors (R1 and R2) and a capacitor (C1) connected to pins 6, 7, and 2 of the 555 timer IC. The formula for calculating the delay time is t = 1.1 x R1 x C1, where t is in seconds. Apply a trigger signal (usually a pulse) to pin 2 of the 555 timer IC. This will cause the output (pin 3) to go high (i.e., to the positive supply voltage). As the output goes high, the capacitor (C1) begins to charge through R1 and R2. Once the voltage across the capacitor reaches two-thirds of the supply voltage (+V_{cc}), the output goes low. When the output goes low, the capacitor discharges through R2. Once the voltage across the capacitor drops below one-third of the supply voltage, the output goes high again, and the cycle repeats.

By adjusting the values of R1, R2, and C1, you can adjust the delay time of the circuit. You can also use other components, such as diodes and transistors, to modify the behavior of the circuit and add additional functionality.

5.2.4. Comparator

The comparator is a component that compares two voltages and produces an output signal based on the result. In a delay timer circuit, the comparator is used to compare the voltage across the timing capacitor with a reference voltage.

5.2.5. Output stage

The output stage is a circuit that provides an output signal based on the delay time produced by the delay timer circuit. The output signal can be used to trigger an event, such as opening a door or turning on a light.

5.2.6. Power supply

The power supply provides the voltage required to operate the delay timer circuit.

5.3. IR Sensor Module:

Table.4 Components used in IR Sensor Module.

S.no	Components	Quantity
1.	Supply	1-9V
2.	Resistance	1-1OOΩ, 2-10KΩ, 1-330Ω
3.	Photo Diode	1
4.	IR LED	1
5.	Amplifier	1-LM358

5.3.1. IR emitter

The IR emitter is a component that emits infrared radiation. It is usually an IR LED (infrared light-emitting diode) that emits radiation in the infrared range, typically at a wavelength of around 940nm.

5.3.2. IR detector

The IR detector is a component that detects infrared radiation. It is usually a photodiode or phototransistor that generates a current when exposed to radiation. The current generated by the IR detector is proportional to the intensity of the received radiation.

5.3.3. Signal conditioning circuit

The signal conditioning circuit is a circuit that amplifies and filters the current signal generated by the IR detector. This circuit may include amplifiers, filters, and other components that improve the signal quality.

5.3.4. Output stage

The output stage is a circuit that processes the output signal from the signal conditioning circuit and generates an output signal that can be used by the user. The output signal may be analog (voltage or current), digital (on/off), or serial (SPI, I2C, etc.), depending on the type of sensor module.

5.4. IC's Pin Diagram:

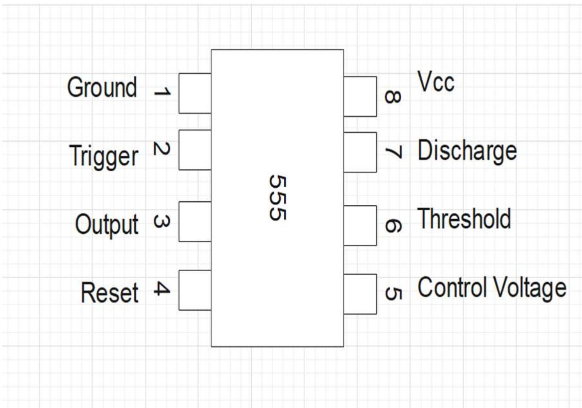


Fig.9 555 Timer IC

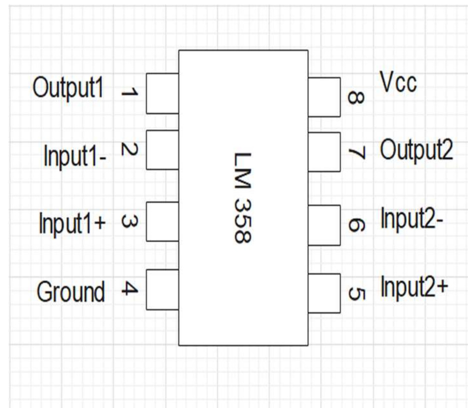


Fig.10 LM358

555 Timer IC: To use the 555 timer IC as a delay timer, we designed the circuit such that a trigger signal initiates the timer, and after a predetermined delay, the output pulse is generated. The timing of the output pulse can be adjusted by changing the values of the external timing components, such as a resistor and capacitor.

LM358: In IR sensor circuits, the LM358 is typically used as a signal amplifier to amplify the small signal generated by the IR sensor. When an object is placed in front of the sensor, the IR light is reflected to the photodiode, generating a small current. This current is then amplified by the LM358, which increases the signal level and makes it suitable for further processing. The LM358 is also often used as a comparator in IR sensor circuits to detect the presence or absence of an object. In this application, the output of the LM358 is compared to a reference voltage, and if the input voltage exceeds the reference voltage, the output of the LM358 changes state.

6. RESULTS AND CONCLUSION:

We have taken a battery of 12V, 26AH for our experiment. By the experiment performed, we get to know that a 2ohm nichrome wire when connected to a 12V DC supply produces sufficient heat in the wire that it gets red hot and able to burn a paper. The 2ohm wire was of length 40cm but we need at least 1m of length to make a coil which is to be used in incinerator. So, we increase the length of wire to 1m but the resistance of wire is 5ohm to reduce the resistance we increase the cross-sectional area of the wire by taking 4wire of 1m and twisted them. Now we get a 1m of wire which has resistance less than 2ohm and made a spiral coil.

6.1. Equations involved in the experiment

Ohm's Law:

$$V = IR \qquad 1.1$$

V-voltage, I-current, R-resistance

Resistance(R):

$$R = \rho \frac{L}{A} \qquad 1.2$$

ρ-resistivity, L-length, A-area of cross section

Power(P):

$$P = VI \qquad 2.1$$

P-power, Power is rate of doing work.

$$P= \frac{W}{T} \qquad \frac{W}{T} = VI \qquad 2.2$$

W-work done, T-total time

Here the work done is the heat produced in the coil

$$H = VIT \quad \text{or} \quad H = I^2RT \qquad 2.3$$

$$H \propto I^2, H \propto R, H \propto T$$

6.2. Heating time calculation and power comparison: Heating wire calculation for the proposed model has been shown in table 1.

Table.5 Comparison table of power and time required in burning.

S no.	Voltage(v)	Resistance(ohm)	Current (Amp)	Power(watt)	Time(sec)
1	11.91	2.5	4.764	56.73	17
2	12	3.8	3.15	37.8	60
3	11.91	5	2.4	28.584	-

6.3. Output images of circuit in working state:

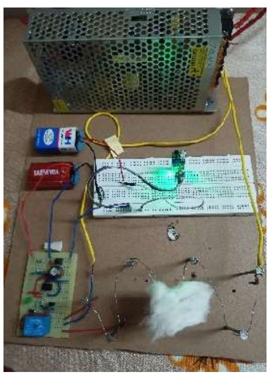


Fig.11 Circuits powered on state.

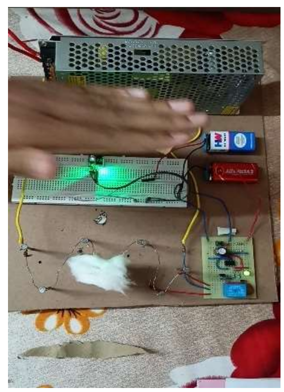


Fig.12 IR sensor detecting turn on gesture.

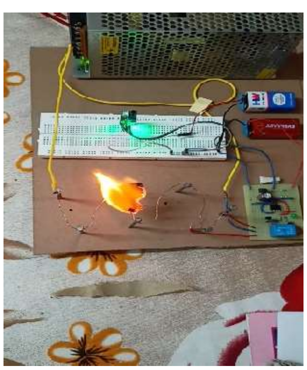


Fig.13 Delay circuit triggered on state and heating of burning coil.

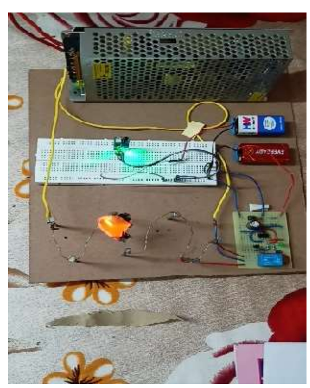


Fig.14 Auto turn off the circuit.

7. Future Scope and advancements:

Sanitary pad incinerators have already made a significant impact on improving menstrual hygiene management by providing a safe and hygienic way to dispose of used sanitary pads. However, there is still a lot of potential for further advancements and improvements in this technology.

Here are some potential future advancements and improvements for sanitary pad incinerators:

- ❖ Energy efficiency: There is a need to make the incineration process more energy-efficient by incorporating newer technologies that use less energy while still ensuring complete combustion of the waste
- ❖ Portable Incinerators: Portable incinerators could be developed that can be easily transported to remote or rural areas where access to proper sanitation facilities is limited. These could be powered by solar energy or other renewable sources.
- ❖ Cost-effective solutions: The cost of the incinerator units and the operational cost of using these units need to be made more affordable, especially in developing countries where the need for such units is the highest.
- ❖ Large Chamber size: We can increase the size of chamber so that more sanitary napkins can be burnt at a time.

8. REFERENCES:

A. G. Tadakhe and P. V. Kokate, "Development and Testing of Low-Cost Sanitary Napkin Incinerator," 2020 5th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kharagpur, India, 2020, pp. 1-5, doi: 10.1109/ICCCNT49239.2020.9225328.

S. S. Sathyanarayana, S. M. Abid, and N. C. Hiremath, "Design and Development of a Portable Sanitary Pad Incinerator," 2021 6th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India, 2021, pp. 1-5, doi: 10.1109/ICACCS51060.2021.9442306.

N. Chatap, N. Barhate, S. Durge, and N. B. Totla, "Solar Powered Incinerator," International Journal of Mechanical and Production Engineering (IJMPE), vol. 7, no. 10, pp. 1-4, 2019.